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CONNECTICUT RIVER BASIN NORTHFIELD, MASSACHUSETTS



SAWYER POND DAM MA 00050

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

OTIC FILE COPY





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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

MARCH 1981

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20. ABSTRACT (Continue on reverse side il necessary and identify by block number)

Sawyer Pond Dam is 170 year old earth embankment about 150 feet long with a top width of 40 feet and a maximum height of about 27 feet. The dam appears to be in fair condition. The dam has been classified as having "Significant" hazard potential. Based on the "Small" size, "Significant" hazard potential, the selected test flood is ½ the PMF.



DEPARTMENT OF THE ARMY

NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254

REPLY TO ATTENTION OF: NEDED

APR 2 1981

Honorable Edward J. King Governor of the Commonwealth of Massachusetts State House Boston, Massachusetts 02133

Dear Governor King:

Inclosed is a copy of the Sawyer Pond Dam (MA-00050) Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, Mr. Nathan Tufts, 359 Main Street, Greenfield, Massachusetts 01303.

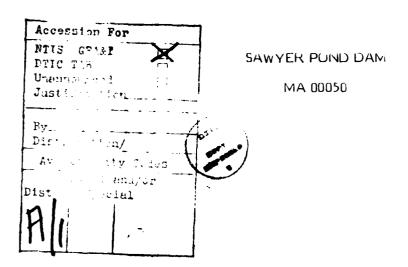
Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Incl As stated C.E. EDGAR, III

Colonel, Corps of Engineers

Division Engineer



CONNECTICUT RIVER BASIN NORTHFIELD, MASSACHUSETTS

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE I INSPECTION REPORT

Identification Number:

Name of Dam:

Town:

County and State:

Stream:

Date of Inspection:

MA 00050

Sawyer Pond Dam

Northfield

Franklin County, Massachusetts

Bennett Brook December 4, 1980

BRIEF ASSESSMENT

Sawyer Pond Dam is a 170 year old earth embankment about 150 feet long with a top width of 40 feet and a maximum height of about 27 feet. Both the upstream and downstream slopes are approximately 1H:1V. The concrete drop box inlet spillway has a crest length of 19 feet. Discharge over the spillway passes through the embankment within an 8-foot by 8-foot concrete culvert. County route #142 (Mt. Herman Station Road) traverses the embankment crest. The dam was originally constructed to provide hydropower for a millworks. The impoundment is currently used for private recreation only.

The impoundment behind the dam is about 1,500 feet long and has a surface area at the spillway crest of about 18 acres. The drainage area above the dam is 3.5 square miles and the maximum storage at the top of the dam is 365 acre-feet. Because the maximum storage is less than 1,000 acre-feet and the maximum height of the dam is less than 40 feet, the size classification is "Small". The discharge from the breach of the dam could affect a railroad bridge about 1,600 feet downstream and a highway bridge about 3,600 feet downstream from the dam. The dam has been classified as having "Significant" hazard potential. Based on the "Small" size, "Significant" hazard potential, the selected test flood is one-half of the Probable Maximum Flood (PMF).

The dam appears to be in fair condition. The roots of trees growing on the embankment slopes may increase the seepage potential and high winds may dislodge the trees removing significant portions of embankment material. The absence of erosion protection on the upstream slope exposes the dam to possible damage from erosion. The deterioration of the upstream retaining walls could lead to slope instability. The dam has a low-level outlet consisting of two, four-inch diameter taps with valves mounted on a blind flange fitted to the downstream end of a 32-inch diameter cast iron pipe outlet.

The test flood inflow for the facility is 3,860 cfs. The routed test flood outflows of 3,570 cfs overtops the dam by 3.2 feet. The spillway capacity prior to overtopping of the dam is 885 cfs or about 25 pecent of the routed test flood outflow.

Within one year after receipt of the Phase I Inspection Report, the Owner, Mr. Nathan Tufts, should retain the services of a registered professional engineer, experienced in the design and construction of dams, for the following purposes: 1) perform detailed hydrologic and hydraulic analyses to determine the need for

increasing spillway capacity; 2) perform an investigation to determine the source and extent of seepage observed at the junction of the concrete drop box inlet and the concrete culvert; 3) direct the removal of trees and their root systems from the embankment and including the area to 20 feet from the toe and direct the backfilling of any remaining voids with suitable, thoroughly compacted material and 4) design and supervise repairs of the deteriorated upstream concrete retaining wall.

In addition, the Owner should implement the following operational and maintenance procedures: 1) remove the 32-inch diameter cast iron pipe and its concrete supports from within the 8-foot by 8 foot concrete culvert; 2) repair the gate system for the low-level outlet; 3) provide riprap protection on those sections of the upstream slope not supported by the retaining wall; 4) remove brush from the embankment slopes; 5) develop a downstream warning plan and during periods of heavy rainfall and/or runoff, monitor the dam and alert the railroad in the event of an impending failure; 6) institute a program of annual technical inspection and 7) establish and implement a regular maintenance program.

O'BRIEN & GERE ENGINEERS, INC.

John J. Williams, P.E. Vice President Massachusetts Registration No.



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Date:		•		Ī		

This Phase I Inspection Report on Sawyer Pond Dam (MA-00050) has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgement and practice, and is hereby submitted for approval.

JOSEPH W. FINEGAN, JR. MEMBER Water Control Branch

Engineering Division

Chames Continuen

ARAMAST MAHTESIAN, MEMBER Geotechmical Engineering Branch Engineering Division

CARNEY M. TERZIAN, CHAIRMAN

Design Branch

Engineering Division

APPROVAL RECOMMENDED:

Du B. Fryan

JOE B. FRYAR

Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation: however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase I Investigation does <u>not</u> include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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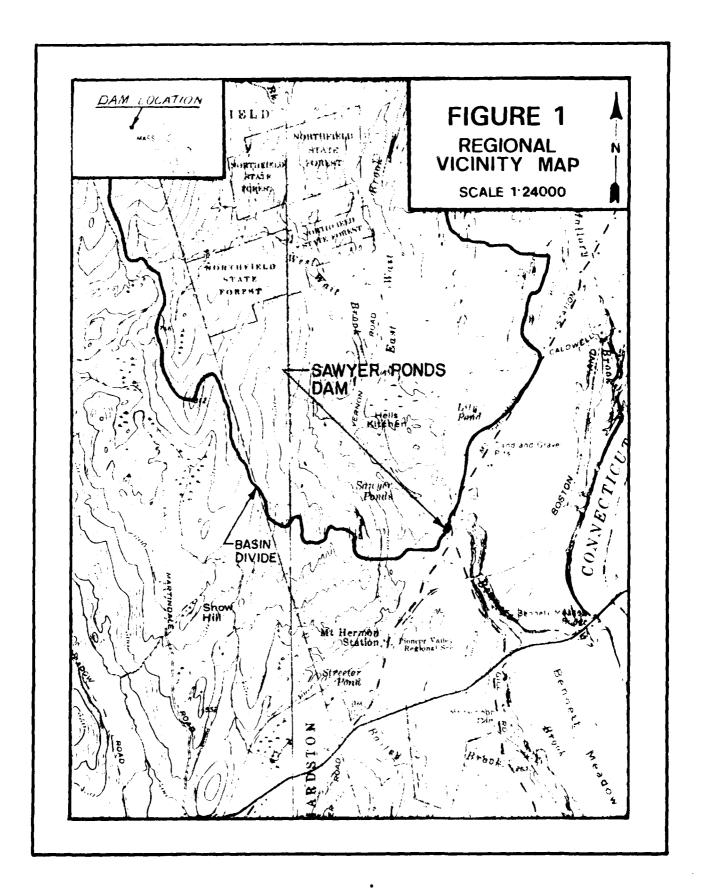
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THE DAM OBSERVED FROM IMMEDIATELY DOWNSTREAM.



NATIONAL DAM INSPECTION PROGRAM PHASE I INSPECTION REPORT SAWYER POND DAM

SECTION 1

PROJECT INFORMATION

1.1 General

- a. <u>Authority</u>. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspections throughout the United States. The New England Division of the Corps of Engineers has been assigned the reponsibility of supervising the inspection of dams within the New England Region. O'Brien & Gere Engineers, Inc., has been retained by the New England Division to inspect and report on selected dams in the Commonwealth of Massachusetts. Authorization and notice to proceed were issued to O'Brien & Gere Engineers, Inc., by a letter from the Corps of Engineers dated November 12, 1980 and signed by Col. William E. Hodgson, Jr. Contract No. DACW33-81-C-0016 has been assigned by the Corps of Engineers for this work.
- b. <u>Purpose of Inspection</u>. The purpose of performing technical inspections and evaluation of non-federal dams is to:
- 1. Identify conditions which threaten the public safety and make the Owner aware of any deficiencies so that he may correct them in a timely manner.
- 2. Encourage and prepare the states to initiate an effective dam safety program for non-federal dams as soon as possible
 - 3. Update, verify and complete the National Inventory of Dams.
- 1.2 <u>Description of Project</u> (Information was obtained from Franklin County, Mr. Nathan Tufts, the Owner, and the Massachusetts Department of Environmental Quality and Engineering (DEQE)).
- a. Location. Sawyer Pond Dam is located on Bennett Brook within the Township of Northfield, MA. The dam is shown on USGS Quadrangle entitled "Northfield, Mass." at coordinates N42⁰41.4', W72⁰29.1'. A regional location plan of Sawyer Pond Dam is enclosed as Figure 1, pg. vi.

Approximately 1,600 feet downstream of the dam is a Boston and Maine Railroad bridge while a road spans the brook about 3,600 feet downstream of the structure. Since the brook enters the wide, flat Connecticut River flood plain about 300 feet upstream of the road and there are no occupied dwellings within the potential floodplain, the railroad bridge and the road are the potential damage centers.

b. Description of Dam and Appurtenances. Sawyer Pond Dam is an earth embankment approximately 150 feet long with a maximum height of about 27 feet. The top width is approximately 40 feet and both the upstream and downstream slopes are about 1H:1V. County route No. 142 (Mt. Herman Station Road) traverses the embankment crest.

The spillway consists of a sharp-crested, vertical drop box inlet discharging into an 8-foot by 8-foot, 56-foot long concrete culvert. The weir crest is 19 feet long and the vertical drop is about six feet. The upstream invert of the culvert is 7.5 feet below the drop box inlet floor elevation.

The outlet works consist of a 42-inch diameter cast iron pipe controlled by a hand-operated gate valve. The pipe, which is located beneath the drop box inlet spillway floor, reduces to a 32-inch diameter pipe within the concrete culvert. The pipe terminates with a blind flange at the downstream end of the culvert. Two four-inch diameter taps with valves pass through the blind flange. Two inlet pipes (one 4-inch diameter and the other 6-inch diameter) with inverts at the floor of the drop box inlet spillway floor are blocked with wood plugs.

- c. <u>Size Classification</u>. Sawyer Pond Dam's maximum storage capacity and maximum height are 365 acre-feet and 27 feet, respectively. The criteria for the "Small" size category includes dams which have a storage capacity between 50 acrefeet and 1,000 acre-feet and a height less than 40 feet. Sawyer Pond Dam is therefore classified as a "Small" size dam.
- d. Hazard Classification. Sawyer Pond Dam is located 1,600 feet upstream of a Boston and Maine Railroad bridge and 3,600 feet upstream of a roadway culvert. Bennett Brook flows into the uninhabited Connecticut River flood plain about 300 feet upstream of the road culvert. A search for the dwellings in the floodplain, which are shown on the USGS quadrangle sheet, revealed that these structures no longer exist. Therefore, the dam is classified as "Significant" hazard since floodwaters could jeopardize the supports of the railroad bridge and inundate the roadway. This assessment is based upon a breach analysis which computed a stream depth of 6.5 feet at the railroad bridge and 5.8 feet (0.8 feet over the road surface) at the road culvert.
- e. Ownership. The dam is owned by Mr. Nathan Tufts, 359 Main Street, Greenfield, Massachusetts 01303. Telephone: (413) 773-3601.
- f. Operator. If operable, the reservoir drain system would be operated by the Owner.
- g. <u>Purpose of Dam.</u> The dam was originally constructed to provide hydropower for a millworks. The reservoir is currently used only for recreation.
- h. Design and Construction History. The original dam at this location was built about 1810. The structure was modified for a millworks for hydropower circa 1928 which operated until March 18, 1936 when the dam was overtopped by about 10 feet. A large section of the embankment was washed away and the downstream millworks were destroyed. The County of Franklin raised the embankment by ten feet, added a concrete retaining wall to reinforce the toe of the upstream slope and rebuilt the dam to its present configuration in 1937. Documentation concerning the 1936 failure and the subsequent repair work are included in Appendix B.

i. Normal Operating Procedures. The reservoir is normally self-regulating with the pool elevation at or above the spillway crest. One of the four-inch taps with valves attached to the low-level outlet remains open to provide minimum discharge (about 5 gpm) in Bennett Brook.

1.3 Pertinent Data

a. <u>Drainage Area</u>. The drainage area above the dam is 3.5 square miles. The watershed is entirely forested with a series of marshes situated along both branches of Bennett Brook.

b. Discharge at Damsite.

- 1. Outlet Works. The maximum discharge capacity of the 32-inch diameter outlet conduit equipped with the two four-inch taps with valves is approximately 4 cfs.
- 2. <u>Maximum Known Flood at Damsite</u>. According to the Owner, Mr. Nathan Tufts, the dam was overtopped by about ten feet in 1936. The top of dam was then 10 feet lower than it is now.
- 3. Ungated Spillway Capacity at Top of Dam. The capacity of the spillway with reservoir at top of dam is 885 cfs.
- 4. Ungated Spillway Capacity at Test Flood Elevation. The spillway capacity with the reservoir at test flood El. 345.7 is 990 cfs.
 - 5. Gated Spillway Capacity at Normal Pool Elevation. Not applicable.
 - 6. Gated Spillway Capacity at Test Flood Elevation. Not applicable.
- 7. Total Spillway Capacity at Test Flood Elevation. The spillway capacity with the reservoir at test flood El. 345.7 is 990 cfs.
- 8. Total Project Discharge at Top of Dam. The capacity of the spillway with reservoir at top of dam is 885 cfs.
- 9. Total Project Discharge at Test Flood. The combined discharge capacity of the spillway and the flow over the dam at test flood El. 345.7 is 3,570 cfs.

c. Elevation. (NGVD)

1.	Streambed at Toe of Dam	315.5
2.	Bottom of Cutoff	Unknown
3.	Maximum Tailwater	Unknown
4.	Normal Pool	332.0
5.	Full Flood Control Pool	NA
6.	Spillway Crest	332.0
7.	Design Discharge	Unknown
8.	Top of Dam	342.5
9.	Test Flood Surcharge	345 .7

d. Reservoir. (Length in Feet)

1.	Normal Pool	1,500
2.	Flood Control Pool	NA
3.	Spillway Crest Pool	1,500
4.	Top of Dam	3,000
5.	Test Flood Pool	3,500

e. Storage. (Acre-Feet)

ı.	Normal Pool	82
2.	Flood Control Pool	NA
3.	Spillway Crest Pool	82
4.	Top of Dam	365
5.	Test Flood Pool	520

f. Reservoir Surface. (Acres)

1.	Normal Pool	18
2.	Flood Control Pool	NA
3.	Spillway Crest	18
4.	Top of Dam	44
5.	Test Flood Pool	52

g. Dam.

1.	Type	Earth Embankment
2.	Length	150 feet
3.	Height	27 feet
4.	Top Width	40 feet
5.	Side Slopes	Vary as 1H:1V
6.	Zoning	Unknown
7.	Impervious Core	Unknown
8.	Cutoff	Unknown
9.	Grout Curtain	Unknown

h. Diversion and Regulating Tunnel. Not applicable.

i. Spillway.

1.	Type	Drop box inlet
2.	Length	19-foot long weir
3.	Crest Elevation	332.0
4.	Gates	None
5.	Upstream Channel	Concrete training walls and impoundment
6.	Downstream channel	8-foot by 8-foot concrete culvert 56 feet long
		which outlete into the natural etream channel

j. Regulating Outlets. A 32-inch diameter cast iron pipe capped with a blind flange which has two, four-inch diameter taps with valves that provide for drawdown below the spillway crest elevation. The inlet and outlet inverts for the 32-inch diameter cast iron pipe are approximately Elevation 320.3 and 317.3 respectively.

SECTION 2

ENGINEERING DATA

2.1 Design

The following information was made available for review of Sawyer Pond Dam:

- 1. Five sketch sheets entitled "Nelson Mills Dam", 10/6/73, showing plan and sections of existing dam.
- 2. Dam inspection reports prepared by the Commonwealth of Massachusetts, Department of Environmental Quality and Engineering, dated September 4, 1973 and November 18, 1975.
- 3. A specifications memorandum, dated October 1937, for repairs to the dam following its failure in 1936.
- 4. A letter dated April 1, 1936, from F. Deane Avrey to the Franklin County Board of Commissioners describing conditions at the damsite following the overtopping failure.
- Franklin County Commissioners approval for the repair of the Cola Nelson Dam in 1903.

No design calculations are available for this site. The principal design features for the structure are shown on the sketches enclosed in Appendix B.

2.2 Construction

Information is not available for the original construction of about 1810. Records indicate that a penstock was added in 1928 to provide hydropower to a downstream millworks. Further details are not available. Specifications are available and included in Appendix B which describe the extent of the repair work performed in 1937 following the 1936 overtopping failure. Specifications are also available and included in Appendix B for the repair work of 1903.

2.3 Operation

According to the Owner, Mr. Nathan Tufts, no operational data is maintained at this site.

2.4 Evaluation

- a. Availability. The information made available for this site was obtained from Franklin County, Mr. Nathan Tufts, Owner, and the Massachusetts Department of Environmental Quality and Engineering.
- b. Adequacy. The drawings, reports, data obtained during the visual inspection and information obtained from the Owner are considered adequate for a Phase I investigation.

c. $\underline{Validity}$. The data obtained during preparation of this report agrees with the measurements obtained during the visual inspection.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General. The field inspection of Sawyer Pond Dam was performed on December 4, 1980. At the time of the inspection, the reservoir water surface was approximately six inches below the spillway crest. No underwater areas were inspected. The dam is considered to be in fair overall condition.

Observations and comments made during the field inspection appear on a checklist included as Appendix A of this report.

- b. <u>Dam.</u> Trees (trunk diameters up to 15 inches) and brush are growing on both the upstream and downstream slopes. No riprap protection was observed on the upstream slope on either side of the vertical concrete retaining walls. The concrete retaining walls have exposed steel reinforcement at the water line. Steel highway guardrails have been placed at the crest of both the upstream and downstream slopes. A two-lane, 28-foot wide asphalt road traverses the length of the crest of the dam. A portion of the downstream toe of the slope is supported by the concrete headwall and training walls for the culvert. No evidence of seepage was observed issuing from the downstream slopes or abutments at the time of inspection.
- c. Appurtenances. Some minor spalling and cracking of concrete in the concrete box drop inlet is evident. A few logs were wedged against the crest and within the box inlet. The gate stem for the 32-inch diameter cast iron pipe outlet is bent and the operating wheel is, according to Mr. Tufts, missing. The gate is rusted in the open position. A six-inch and a four-inch diameter cast iron pipe, both extending through the box inlet wall at its invert are blocked with wood plugs. Leakage was not evident around the wood plugs. Seepage is evident (5 gpm) at the junction of the drop box inlet and the culvert. The concrete within the culvert is in fair condition. The cast iron pipe outlet inside the culvert is rusted and its concrete support pedestals are deteriorated. One of the four-inch diameter tap valves at the downstream end of the outlet pipe is partially open allowing a discharge of about 5 gpm. The concrete culvert head wall and wingwalls appear to be in good condition.
- d. Reservoir Area. The slopes on the reservoir shoreline are heavily forested. Evidence of slope instability or reservoir siltation are not apparent.
- e. <u>Downstream Channel</u>. The channel downstream of the dam is a narrow stream valley with steep, heavily forested side slopes. A small, deteriorated concrete weir about three feet high is located about 100 feet downstream of the dam. The stream valley is spanned by a railroad bridge about 1,600 feet downstream of the dam. Although the bridge deck is about 65 feet from the streambed, the supports would be exposed to floodwaters should the dam fail. A roadway passes over Bennett Brook about 3,600 feet downstream of the dam which is about 300 feet after the stream channel enters the wide, flat Connecticut River floodplain.

3.2 Evaluation

The dam appeared to be in fair condition at the time of inspection. All brush

and trees should be removed from the embankment slopes. Erosion protection should be placed on the upstream slope. The intake gate for the low-level outlet should be repaired. The upstream concrete retaining walls should be repaired. The 32-inch diameter cast iron pipe outlet and its concrete supports inside the 8-foot by 8-foot concrete culvert should be removed.

SECTION 4

OPERATIONAL AND MAINTENANCE PROCEDURES

4.1 Operational Procedures

- a. General. According to Mr. Tufts, Owner, no formal operating procedures are established for operation of Sawyer Pond Dam.
- b. Description of Warning System in Effect. According to Mr. Tufts, Owner, no flood warning system is in effect at this site.

4.2 Maintenance Procedures

- a. General. According to Mr. Tufts, the Owner, there is no maintenance program for the dam.
- b. Operational Facilities. The gate valve controlling discharge into the low-level outlet and one of the four-inch diameter tap valves connected to the end of the outlet are inoperable.

4.3 Evaluation

The operational condition of the outlet works is inadequate because the controlling gate valve for the low-level outlet are inoperable and the two four-inch diameter tap valves have insufficient capacity for emergency drawdown of the reservoir.

SECTION 5

EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General

Sawyer Pond Dam has a 3.5 square mile drainage area about three miles long and an average width of about one mile. The drainage area is entirely forested with a few low-lying marshes where stream channels are not well defined. The topography ranges from El. 1245 in the mountainous upper reaches of the drainage basin to El. 332 at the damsite. No other significant impoundments are located in the watershed.

5.2 Design Data

Neither hydraulic nor hydrologic design data are available for Sawyer Pond Dam.

5.3 Experience Data

The dam was breached when it was overtopped by about ten feet on March 18, 1936. Further records of high reservoir stages are not available.

5.4 Test Flood Analysis

The recommended test flood range for a "Small" size, "Significant" hazard dam is from the 100 year storm to one-half of the Probable Maximum Flood (PMF). Considering the downstream hazard areas, the selected test flood for this structure is one-half of the PMF.

Hydrologic and hydraulic calculations were performed with the assistance of the HEC-1-DB computer program. The flood hydrographs were constructed from the Snyder unit hydrographs using average coefficients, an initial infiltration of zero, and a constant loss rate of 0.05 inches per hour. The Hop Brook Adjustment Factor was used to reduce the Probable Maximum Precipitation based on the size of the drainage area. Stage vs. Discharge and Stage vs. Storage relationships were developed for Sawyer Pond Dam. These relationships were utilized by the program to route the test flood through the dam. Sawyer Pond was assumed to have a reservoir water surface elevation at the spillway crest at the beginning of the storm event.

The peak inflow and routed outflow for the test flood at Sawyer Pond Dam were calculated as 3,860 cfs and 3,570 cfs, respectively. The peak outflow corresponds to a reservoir stage of 13.7 feet above the spillway crest, or 3.2 feet above the top of dam elevation. The spillway capacity prior to overtopping of the dam was calculated to be 885 cfs, which is 25 percent of the routed test flood outflow.

¹Corps of Engineers, Engineering Circular No. 1110-2-27, Aug' 66

5.5 Dam Failure Analysis

A failure of the dam was simulated by the HEC-1-DB computer program assuming a 36-foot wide and 24-foot deep breach with vertical side slopes, developing within one hour. The breach of the dam is assumed to occur with the reservoir surface at the top of dam elevation. This is compared with discharge through the spillway with the reservoir surface at the top of the dam with no failure.

The resulting outflow was routed 1,600 feet downstream to the railroad bridge which has a deck elevation about 65 feet above the streambed. The channel cross-section at this location is shown on page D-6. The stream depths at the railroad bridge were computed to be 7.8 feet and 2.7 feet for the breach and non-breach conditions, respectively. The discharge for the breach condition is 8140 cfs compared to 1030 cfs for the non-breach condition. A failure of the dam could damage the bridge supports causing appreciable property damage but with little chance of loss of life.

An additional hazard center consisting of a highway bridge located about 3,600 feet downstream of Sawyer Pond Dam and lying within the Connecticut River floodplain was also evaluated for damage potential. The stream depths at the highway bridge were computed to be 6.7 feet and 4.0 feet for the breach and non-breach conditions, respectively. The discharge for the breach condition is 7790 cfs compared to 1030 cfs for the non-breach condition. A failure of the dam would result in 1.7 feet of water flowing over the highway surface at the bridge with possible appreciable damage to the bridge resulting, but with little chance of loss of life.

SECTION 6

STRUCTURAL STABILITY

6.1 Visual Observations

The roots of trees growing on the dam crest could provide increased seepage potential through the embankment. High winds could dislodge the trees and their root systems causing significant losses of embankment material. The absence of riprap protection on the upstream slope exposes the embankment to erosion. The deterioration of the upstream concrete retaining walls, which support a section of the embankment, could lead to slope instability. The seepage at the junction of the drop box inlet and the culvert could lead to piping of soil from the embankment.

6.2 Design and Construction Data

According to the Owner, Mr. Tufts, no information is available concerning stability analyses, seepage computations or embankment and foundation material properties.

6.3 Post Construction Changes

The dam was extensively rebuilt after it was overtopped and breached in 1936. The existing upstream masonry retaining wall was reinforced with a new concrete wall and the embankment was raised about 10 feet. The 8-foot square box culvert was built at this time. Details concerning this reconstruction are presented in Appendix B.

6.4 Seismic Stability

Sawyer Pond Dam is located in Seismic Zone 2 on the "Seismic Risk Zone Map of Contiguous States". A dam located in Seismic Zone 2 need not be evaluated for seismic stability according to the Recommended Guidelines for Phase I Dam Inspections.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Condition. The visual observations and review of the available information indicate that Sawyer Pond Dam is in fair condition. The roots of trees growing on the upstream and downstream slopes may increase the seepage potential and high winds may dislodge the trees removing significant portions of embankment material. The absence of riprap protection on the upstream slope exposes the embankment to erosion. The deterioration of the upstream concrete retaining walls could lead to slope instability. The seepage at the junction of the drop box inlet and the culvert could lead to piping of soil from the embankment.
- b. Adequacy of Information. The drawings, reports, data obtained during the visual inspection and information obtained from the Owner are considered adequate for a Phase I investigation.
- c. Urgency. The recommendations and remedial measures described in Sections $\overline{\text{7.2}}$ and $\overline{\text{7.3}}$ should be implemented within one year of receipt of this Phase I Inspection Report.

7.2 Recommendations

It is recommended that the Owner retain the services of a qualified, registered professional engineer experienced in the design and construction of dams for the following purposes:

- 1. Perform detailed hydrologic and hydraulic analyses to determine the need for increasing the spillway capacity.
- 2. Perform an investigation to determine the source and extent of seepage observed at the junction of the concrete drop box inlet and the concrete culvert.
- 3. Direct the removal of trees and their root systems from the embankment and including the area to 20 feet from the toe and direct the backfilling of any remaining voids with suitable, thoroughly compacted material.
- 4. Design and supervise repairs of the deteriorated upstream concrete retaining wall.

7.3 Remedial Measures

- a. Operation and Maintenance Procedures. The Owner should also implement the following operation and maintenance measures:
- 1. Remove the 32-inch diameter cast iron pipe and its concrete supports from within the 8-foot by 8-foot concrete culvert.

- 2. Repair the gate system for the low-level outlet.
- 3. Provide riprap protection on those sections of the upstream slope not supported by the retaining wall.
 - 4 Remove brush from the embankment slopes.
- 5. Develop a downstream warning plan and during periods of heavy rainfall and/or runoff, monitor the dam and alert the railroad in the event of an impending failure.
 - 6. Institute a program of annual technical inspection.
 - 7. Establish and implement a regular maintenance program.

7.4 Alternatives

No valid alternatives to the recommendations above are considered feasible for this site.

APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST INSPECTION TEAM ORGANIZATION

Project:	Sawyer Pond Da	9/17	
National I.D.#:	4.4.4		
Location:	Northfield, Ma		
Type of Dam:	Earth Embanke	nent	
Inspection Date(s):_	December 4, 1	980	.
Weather:	Clear, cold =2	OP	··
	≈ 33/.5		
Inspection Team Lee DeHeer Leonard Beck Steven Snider Alan Hanscom Denis Mehu	O'Brien & Ger O'Brien & Ger O'Brien & Ger O'Brien & Ger Bryant & Asso	·e ·e	Managing Engineer Structures Foundations & Materials Structures Hydrology/Hydraulics
Owner's Representati	ve		
Nathan Tubts	Owner		<u> </u>

VISUAL INSPECTION CHECK LIST

Project: SAWYER POND DAM

National I.D. #: MA 00050

Date(s): December 4, 1980

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT	
Crest Elevation	342.5
Current Pool Elevation	331.5
Maximum Impoundment to Date	2344 (1936 Flood, Dam Crest at 334)
Surface Cracks	None.
Pavement Condition	Roadway in good condition.
Movement or Settlement of Crest	None.
Lateral Movement	None.
Vertical Alignment	Good.
Horizontal Alignment	Good.
Condition at Abutment and at Concrete Structures	No problems noted.
Indications of Movements of Structural Items on Slopes	None.
Trespassing on Slopes	None.
Vegetation on Slopes	Brush and trees with trunk diam. up to 15 inches on both slopes.
Sloughing or Erosion of Slopes or Abutments	None.
Rock Slope Protection - Riprap Failures	Absence of riprap protection.
	A-2

And the state of t

VISUAL INSPECTION CHECK LIST

Project: SAWVER POND DAM

National I.D. #: MA 00050

Date(s): December 4, 1980

AREA EVALUATED	CONDITIONS
DAM EMBANKMENT (Con't)	
Unusual Movement or Cracking at or near Toes	None.
Unusual Embankment or Downstream Seepage	None.
Piping or Boils	None.
Foundation Drainage Features	None.
Toe Drains	None.
Instrumentation System	None.

A.3

VISUAL INSPECTION CHECK LIST	
Project: SAWYER POND DAM	
National I.D. #: MA 00050	
Date(s): December 4, 1980	
AREA EVALUATED	CONDITIONS
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
AND DISCHARGE CHANGES	
a. Approach Channel	
General Condition	Fair. None.
Loose Rock Overhanging Channel .	None.
Trees Overhanging Channel	Hone. Lake bottom.
Floor of Approach Channel	Lake bottom.
b. Weir and Training Walls	
General Condition of Concrete	Fair. At waterline.
	i i
Spalling	Spalling noted at waterline. Exposed at water line.
Any Visible Reinforcing	Exposed at water line.
Any Seepage or Efflorescence	None observed.
Drain Holes	None.
c. Discharge Channel	
Gener al Conditi on	Concrete culvert in fair condition Some spalling and scepage noted at junction of culvert and box drop inlet structure. A-4

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VISUAL INSPECTION CHECK LIST		
Project: SAWYER POND DAM		
National 1.D. #: <u>A1A 00050</u> Date(s): <u>December 4, 1980</u>		
Date(s). 15ecc///be/ 4, 1400		
AREA EVALUATED	CONDITIONS	
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS (Con't)		
Loose Rock Overhanging Channel	None.	
Trees Overhanging Channel	None.	
Floor of Channel	Noticial StreamLed.	
Other Obstructions	A three foot high concrete weir blocks the channel about 100 feet d/s of the culvert outlet.	
	A-5	

VISUAL INSPECTION CHECK LIST	
Project: SAWYER POND DAM	
National I.D. #: MA 00050	
Date(s): December 4, 1980	
·	
AREA EVALUATED	CONDITIONS
OUTLET WORKS - CONTROL TOWER	
a. Concrete and Structural	
General Condition	Fair.
Condition of Joints	Fair. Good. Minor.
Spalling '	Minor,
Visible Reinforcing	At waterline.
Rusting or Staining of Concrete	Some.
Any Seepage or Efflorescense	None. Good
Unusual Seepage or Leaks in Gate Chamber	None.
Cracks	None. Exposed steel corraded
Rusting or Corrosion of Steel	Exposed steel corraded
b. Mechanical and Electrical	
Air Vents	/J/A
Float Wells	/J/A /J/A /J/A
Crane Hoist	NA
	A-6

	• • •				
VISUAL INSPECT	ION CHECK LIST				
Project: SAWYER POND	DAM				
National I.D. #: MA 00050					
Date(s): Docember 4, 19	980				
AREA EVALUATED	CONDITIONS				
OUTLET WORKS - CONTROL TOWER (Con't)					
Elevator	NA				
Hydraulic System	N/A				
Service Gates	Gate hoist and stem not connected to be interded to propositive it Gate Stem bent, wheel missing corroded in open position.				
Emergency Gates	None.				
Lighting Protection System	N/A				
Emergency Power System	N/A N/A				
Wiring and Lighting System in Gate Chamber	N/A				

VISUAL INSPECTION CHECK LIST Project: SAWYER POND DAM National I.D. #: MA 00050 Date(s): December 4, 1980 CONDITIONS AREA EVALUATED **OUTLET WORKS - TRANSITION AND CONDUIT** General Condition of Concrete None. Rust or Staining on Concrete Minor. Spalling None observed. Erosion or Cavitation Hairline cracks observed. Cracking Alignment of Monoliths N/A Alignment of Joints Numbering of Monoliths

APPENDIX B
ENGINEERING DATA

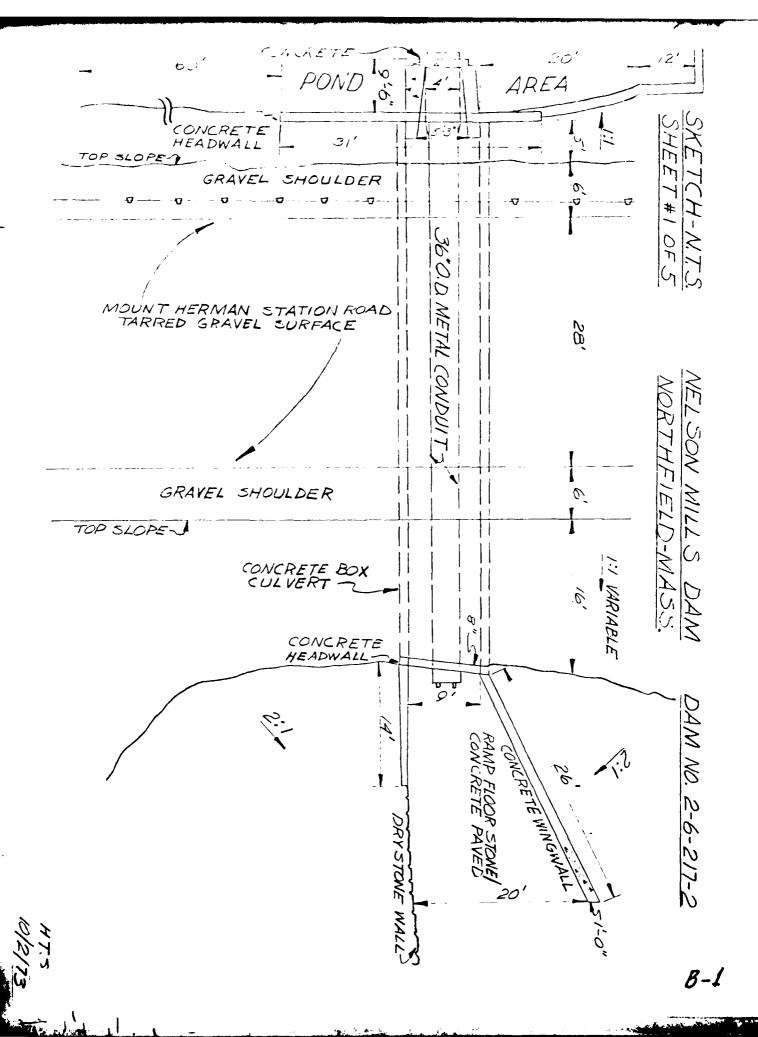
SAWYER POND DAM

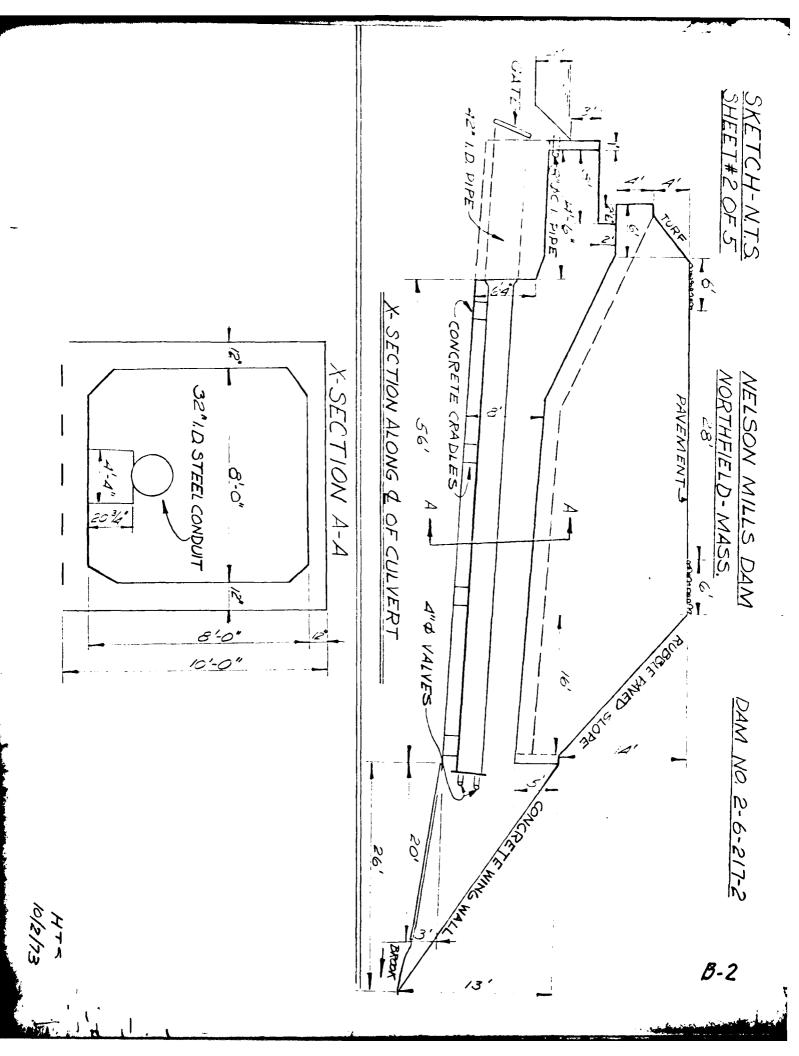
APPENDIX B

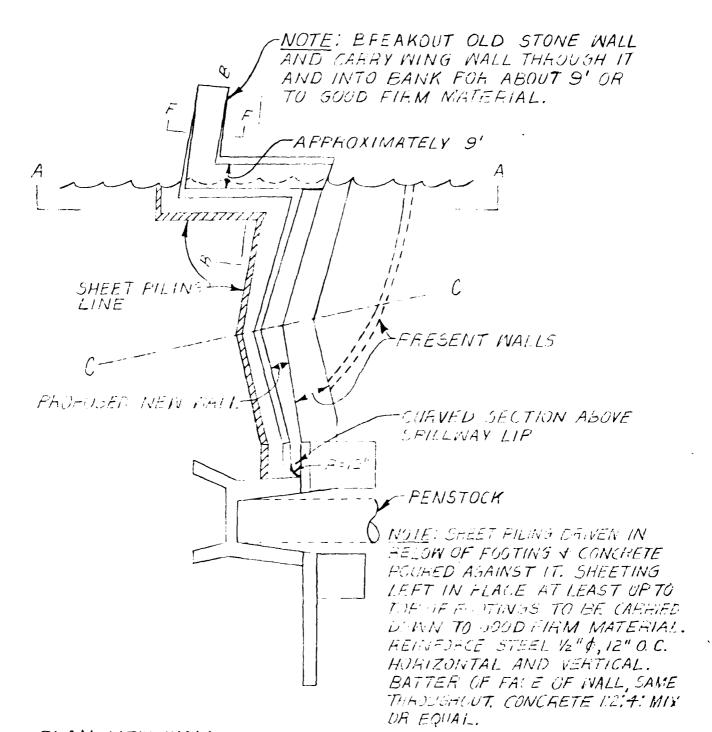
ENGINEERING DATA

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Authorization for Repairs to Dam, 1903	B-6 and B-7
Specifications for Strengthening Cola Nelson's Dam, 1903	E-8 and B-9
Inspection Reports on Dam, 1936	B-10 through B-12
Specifications for Repairs to Helson's Mill Dam, 1937	B-13 through B-15
Inspection Report, 1973	B-16 through B-21
Inspection Report, 1976	B-22 through B-26



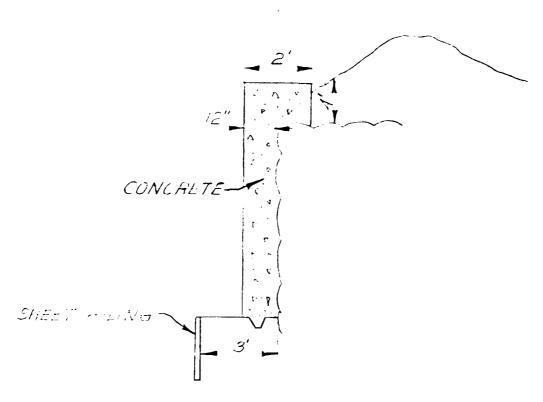




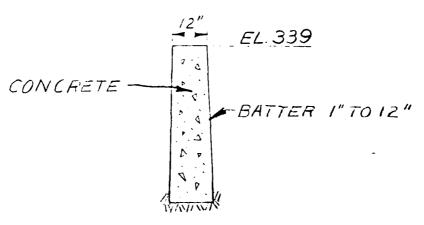
PLAN NEW WALL
FROM PLAN MAY 1, 1937
REVISED MAY 24,1937
COPIED PHOM PLAN IN
COUNTY COMM. OFFICE.

B-3

F.C. F.TK. 3/24/73 SYF7CH-V.T.S. 5HEET # + 145 SHEET E STA-E-C NELECTO MICE DAW - DAM 100-SANVER HOND 2-1-2 T-



CROSS SECTION B-B

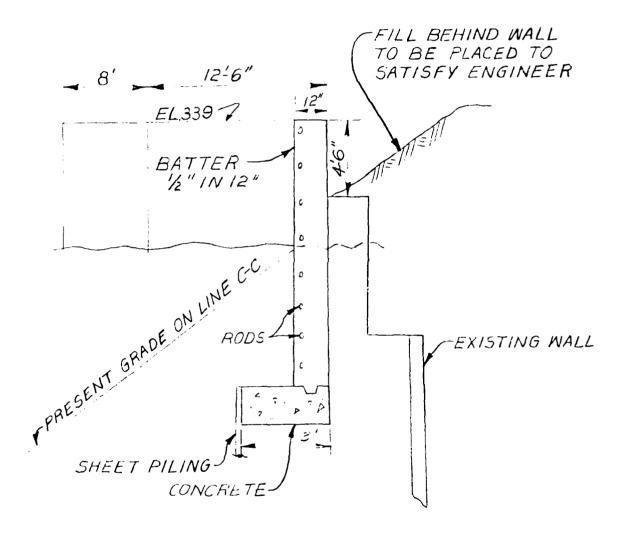


CROSS SECTION F-F

COPIED FROM PLAN IN COUNTY COMM. OFFICE

1. B. G. SA. 9/2+/73

SKETCH N.TS. SHEET = 5 of 5 SHEET C of A-B-C NELSON MILLS DAM-SAWYER POND NORTHFIELD, MASS. <u>DAM NO.</u> 2-6-217-2



CROSS SECTION A-A

COPIED FROM PLAN IN COUNTY COMM. OFFICE.

Authorization for Repairs to Dam 1903 BOARD OF COUNTY COMMISSIONERS.

County of Franklin.

January 6th. A.D.1903.

Holton and others, Selectmen of Northfield, in said County, filed their petition with this Board, representing that the dam and reservoir of Cola Nelson, at Mount Hermon, by reason of their having been raised to an unsafe height, was an element of danger to the highway and bridges, and to private property below the dam, and praying that said Board view the premises, with reference to the rights and safety thereof.

And said Board being of opinion that the public good require that said dam and reservoir be examined, after due notice, a view and hearing was had on the thirtieth day of September A.D.1902, when said Commissioners caused said dam to be examined by Charles J.Day, a competent and experienced engineer, in company with this Board and said petitioners.

On the twenty-third day of December A.D.1902, said engineer reported to this Board, that in his opinion said dam was unsafe and an element of danger to the highway and bridges and to private proper below said dam, and recommended that said dam be re-enforced and strengthened in accordance with the plans and specifications hereto annexed.

Said petition was then continued to the meeting of said in Commissioners held at Greenfield, on the second Tuesday of December A.D.1902, and by adjournment on this sixth day of January A.D.1908.

Whereupon this Board having carefully considered the report of said engineer, in connection with the examination made of said dam, and reservoir by it, find that said dam and reservoir are not permanent and secure, and that there is liability of damage to the highway and bridges and to private property below said dam as at present construct and that said dam should be altered and strengthened, and said engineer at the request of this Board, having filed with it in the case, plans and specifications for the alterations and strengthening of said dam said plans and specifications are hereby adopted by this Board and made a part of this decree. And it is ordered and decreed by said demonstrates that the alterations and strengthening of said dam and reservoir as aforesaid, be made as soon hereafter as may be, and on or before the first day of October A.D.1903, in accordance with said plans and specifications.

Openla Howes

Osgard Lo Locale

County Commissioners.

is to be performed and paid for by Cola Nelson, and consists principally of the construction of the concrete walls as shown on accompanying plan for the protection of the road-way and the well walls.

The second part relates to the work of re-constructing thet.

culvert and raising the road-bed in accordance with the accompanying plan, and is to be performed and paid for by the Selectment of the town of Northfield, Mass.

- FIRST PART -

The present concrete wall if found to be suitable and sufficient when the water is drawn off and the present crib removed so that a careful inspection can be made, is to be raised and extended substantially as shown on the plan. In place of the present wooden crib is to be constructed a square well, the walls of which are to be of concrete and the construction to be substantially as shown on plan. The present penstock is to be extended through the well and far enough beyond the westerly side of same to be convenient for the gate construction. The elevation of the top of the well walls is to be the same as the top of the flash board was December 18th. 1902.

As the nature of the ground at the bottom of the pondvisinot known, directions for the construction of foundations will not being given until the water is drawn off and soundings can be made, sat which time directions will be given by the County Commissioners or their engineer as to all necessary details of construction.

Mr. Nelson is to raise the bridge on the Back Road as may be

directed by the County commissioners

Mr. Relson is to give the County Commissioners not less than one week's notice before he is ready to begin the construction of his part of the work.

- SECOND PART -

The Selectmen of the town of Northfield are to re-construct walls
the culvert substantially as shown on plan. This calls for the removal
of the present covering stones and raising the side walls one foot
projecting the new top courses six inches in on each side with stones
that cover the whole top of the walls. Three or four feet of the
westerly end of the culvert will be raised several feet as shown on
plan so as to allow a much larger opening for the flow of water. The
grade of the road is to be raised as shown on plan over the culvert
and around the Back Road so-called.

when the culvert is uncovered, the Selectmen of Northfield are to notify the County Commissioners of the fact. The culvert is to be left uncovered until it is inspected by the said County Commissioner or their engineer, or word is received that they do not care for such inspection. In case the said County Commissioners or their engineer after a careful inspection consider the present culvert insufficient and unsafe they will thereupon give such directions in regard to the reconstruction as they may deem necessary.

The Selectmen of Northfield and Mr. Nelson are to act as much in conjunction as may be necessary for the proper performance of the entire work.

Greenfield, January 6th. 1903.

Engineer.

B-9

F. DEANE AVERY

CIVIL ENGINEER
17 DICKINSON STREET

GREENFIELD, MASS. April .

10 36

Honorable Board of County Commissioners.

Franklin County,

Greenfield. Mass.

Dear Sirs.

At the request of your chairman I have today visited the dam at Nelson's Mill, so called, owned by Nathan Tufts of Greenfield and located about one mile north of Mount Hermon in the Town of Northfield.

The dam and the road were apparently so closely related as to be almost one structure. The road crossed the ravine on an earth fill with a bridge of apparently short span located over the flume and spillway. The flume looks to be $2\frac{1}{2}$ or 3 feet in diameter, of boiler iron, and runs to a water wheel in the old mill, a part of which is still standing close to the downstream side of the road. So far as I could see from the dam the flume appeared to be in good condition. It is located directly under the spillway which is of concrete, rectangular in shape, with water flowing over three sides, the other side being at the end of the bridge.

Mr. Tufts told me that in the evening of March 18 the downstream side of the bridge went out, and later the full width of the roadway went. At some time a portion of the old mill collapsed but I do not know when. After the bridge went out the water washed out considerable fill on the far side and left exposed about 20 feet of concrete which was located about at the upstream railing and which

B-10

the top and nearly vertical at the back or downstream side which is exposed to about 12 feet below the spillway at the lowest point. The upstream side is filled with gravel to within about 12 feet of the spillway level and with a slope of about 2 to 1 but it is far from tight and there is considerable leakage at what looks to be the bottom of the wall and at the far end. It is impossible to tell whether there is any leakage near the spillway.

The wall, so far as can be seen, is too light to act as a dam and is probably held in place by the support it receives at its ends. Just below the old mill is a new timber trestle for the highway and about a quarter mile below is the B&M RR culvert. These are the only structures that I know of on the stream below but there is a lot of water in the pond.

In my opinion the dam is at present unsafe and I therefore recommend that the water be lowered immediately to the level of the flume and that plans be submitted for permanent repairs.

Very truly rours.

F. Deane Avery

FDA/HF

Real and Rend 14/34.
Norther La.

F. DEANE AVERY

CIVIL ENGINEER 17 DICKINSON STREET

GREENFIELD, MASS.__

April 13,

Honorable Board of County Commissioners.

Franklin County,

Greenfield, Mass.

Dear Sirs.

On April 11th I again examined the dam at Nelson's Mills. Some efforts have been made to stop the leaks by putting loam on the upstream side but the situation is not much changed since my previous visit. It is not leaking any worse and I should think not so bad as when I saw it before. The sand bags have not been placed yet.

The dam in its present condition withstood higher water than we have at present and may stand for some time but I still recommend that the water be lowered at once and I so advised; the man on the place. He promised to see Mr. Tufts and have him let me know what he proposed to do next.

Very truly yours,

F. Deane Avery

FDA/HF

Jan Jan ?

MEMORALDUM SPECIFICATIONS

REPAIRS TO NELSON'S HILL DAM .

NORTHFIELD, MASS,

EXCAVATION

The excavation for the walls is to be carried at least to the bottom of the present walls, with sheet piling on the pond side which is to be driven below the bottom of the trench at least 6 in. The bottom portion of the sheet piling is to be left in place and cut off not lower than the top of the wall footing nor higher than elevation 328.

Where the excavation requires digging below the bottom of any existing wall the work shall be done in sections not exceeding 10 ft. in length. The concrete footing of each section shall be completed before excavation in the neighboring section is started.

CONCRETE

The cement shall fulfill the latest standard of the American Society of Testing Materials. The aggregate is to consist of suitable local bank-run gravel. Care shall be taken in excavating the gravel from the pit that no loam or surface soil is mixed with the gravel. The cement and the gravel shall be mixed in such proportion that the concrete shall contain at, least 1.5 bble. (6 bags) of cement per cu. yd. of concrete in place. Concrete is to be thoroughly mixed in a batch mixor, each batch being mixed at least two minutes.

The concrete in the wall foundations is to be poured directly against the sheet piling of the trench without any form. The concrete is to be poured in the dry. Care must be taken that water

shall not be pumped from the trench in such a way that it flows through concrete being placed.

At all joints, horizontal and vertical, where concrete is poured against concrete already in place adequate keys, as shown on the plans, shall be provided.

The surface of the old concrete shall be carefully cleaned of all soum or laitence. The first concrete poured shall consist of a layer of cement and sand mortar mixed 1 part cement to 2 of sand, at least 1 in. thick.

REINFORCEMENT

Reinforcement shall consist of rods carefully wired together to hold them in place. The plan shows 1/2 in. rods, but other steel rods not less than 3/8 in. nor more than 1 in. in diameter may be used instead. Rods larger than 1/2 in. may be spaced correspondingly wider than the 12 in. shown, up to 24 in. for 1 in. rods. Old rods shall be cleaned of all rust scales before being used. Rods may be spliced by lapping and wiring together, but the lap for each splice shall be of a length at least 40 times the diameter of the smallest rod. CLEANING OLD CONCRETE WALLS

When the new concrete wall comes into contact with the present concrete wall, the old concrete shall be thoroughly cleaned and brushed with a wire brush. All loose stone and other material is to be removed. It shall be wet before the new concrete is placed against it.

Where the concrete wall comes in contact with the old masonry wall, the old masonry wall shall be thoroughly washed and the joints between the stones raked out for a depth of at least 3 in. so that the new concrete will flow into the joints of the old stone work.

B-14

FILL

Backfill is to be placed on the upstream side of the new concrete wall to within 5 feet of the top of the wall. Material excavated for the construction of the wall if suitable may be used for this purpose. It shall be placed in horizontal layers not exceeding Lain. thick, tamped or puddled in place. The line of the fill to be substantially as it is at present.

On the downstream side the wall is to be filled in as a serior faction of the length and the mater in the pond is to be kept drawn down until this filling is done.

Samuelle Stracter

Canto Oller Country

Commissioners

Willen & Bu sham Commissioners

October 31, 1973

Mr. Mother Tufta 500 Main Streat Greenfield, Massachusetts 01301

> Inopiesol (1 + 2 is lengthings) -1 door Mill (1 is is the constants)

Doar !'r. Tufts:

An engineer from the Massachusettte Depart hit of Rublic Chas increated the above day, of thick you are the cunor.

The inspection was made in assemble to with Chapter 250 c Massachusetts General Laws, as amoneed by Chapter 505 of the most 1970.

The results of the improvision inclinate Chab mapairs are the following conditions three moded that require absentables

- 1. Ropair the upstroum face table there they have oroded at the naturaline emporing the reinference stool.
- 2. Remove the growth of trace from the call mimons of the dam, particularly those growing near the drop inlet.
- 3. Repair or replace one of the velves at the dom-
- 4. Remain or replace the gute and its supports for Rodney sunt gate.
- 5. Remove the beaver track from the apillular.

-2-

October 32

We will those conditions to your mite when now, before to become sorious and more empenative to connect.

Vory truly yours,

Find. C. Solmelmu.
Find. C. Solmilli, 2.2.
Loputy Class Include

LRAthlb cotf.J.Hoog R. Salla

5-17

DULCRIPTION OF DAIL

DISTRICT 2 . Submitted by H. T. Shumway Dam No. 2-6-217-2 Date September 4, 1973 Gim/Town Northfield ___ Name of Dam Nelson Mills Dam "Sawyer Pond" ı. Hass. Rect. Location: Topo Sheet No. 13A Coordinates N 617,600 E 234,800 Provide $8\frac{1}{2}$ " x 11" in clear copy of topo map with location of Dam clearly indicated. Bennett Brook where Mt. Hermon Station Road "Route 142" crosses 50 feet south of Vernon Road. 2. Year built Unk Year/s of subsequent repairs Repair in 1037 at same time Et. Herron Station Road Rebuilt. 3. Purpose of Dam: Water Supply Recreational X Flood Control _____ Other Formerly Cld Fill Ex-4. Drainage Area: 3.3 sq. mi. acres. Type: City, Bus. & Ind. ____ Dense Res. ___ Suburban ___ Rural, Farm 100: Wood & Scrub Land X Slope: Steep 80% Med. 10% Slight 10% 5. Normal Fonding Area: 20.5 Acres; Ave. Depth 4. Impoundment: 26.4 million gals.; 82 acre ft. Silted in: Yes X No Approx. Amount Storage Area 305 6. No. and type of dwellings located adjacent to pond or reservoir 1 i.e. summer homes etc. Summer Comp 7. 8-18 Dimensions of Dam: Length 211' - 6" Max. Height 30' Freeboard 12' to too of road surface Slopes: Upstream Face Vertical on conc. - 1:1 on embankment Downstream Face Vertical on conc. - 1:1 veriable on ei banktient Width across top _____401 The state of the s

				- 2 -		Dam No.	2-6-217-2
	Cla	ssification of	Dam by Materia	al:			
		Earth	Cone.	MasonryX	st	one liasoni	<u> </u>
•		Timber	Rockfi	.11	_ Ot	her	
84.	Dam		ty <u>%</u> Str			Arched	Other
9.	Α.	Description of	present land		ream of da	ım:	
	В.	Is there a sto could accommod dam failure?	rage area or f	lood plain do	event of		
	C.	Character Down	stream Valley:	Narrow			Developed
10.	Ris	No. of homes No. of busine No. of indust No. of utilit Railroads	1 sses None ries None ies	Type			
		Other dams	ione ts and Bridges	under town w	a ys and u	nder Route	10

11. Attach Sketch of dam to this form showing section and plan on $8\frac{1}{2}$ " x 11" sheet.

RCS/vk/rt Attachments Locus Plan Sketches

Five (5) smeets plus 3 pages of Specification for 1937 Repairs.

•	•		,	٠	-				-				
-	·	• •	•	•	·	•		=	_	i	_	•	 _

(12.)

OVERALL CONDITION:

ı.	Safe
2.	Minor repairs needed
3.	Conditionally safe - major repairs needed X
4.	Unsafe
5.	Reservoir impoundment no longer exists (explain)
	Recommend removal from inspection list

REMARKS AND RECOMMENDATIONS: (Fully Explain)

This dam was extensively repaired in 1937 when the 8' x 8' box culvert was installed under Chapter 90. See plan for culvert Northfield Mt. Hermon Road at cutlet to Relson Fond, Bridge No. N-22-22 on file at Department of Fublic Works. At that time an upstream facewall was installed and the existing drop box inlet repaired. Flans on file at Franklin County Commissioners Office, Volume 15, Fage 175. It appears that the entire structure is within the County Highway Layout and that the Water rights are owned by Mr. Natham Tufts.

In 1937 the existing 42" penstock was recoved downstream of the concrete drop box and an eccentric reducer installed to a new 32" diameter penstock which rests on concrete piers in the 3' x 8' box culvert. The original construction plans were evidently modified in the field, as the concrete color around the old 42" penstock and eccentric reducer is extended downstream almost to the 32" penstock and the slopin, portion of the culvert roof was also extended to provide capacity for the water flowing through the culvert.

At the time of this inspection the downstrear end of the 32" jenstack was capied with two 4 inch valves in the cap, both of which were open. One of these valves is daraged so badly as to be inoperative. The upper end of the jenstack at the cutaide well of the drop inlet is covered with beaver trash and the emposed jate sten of the joiney dunt type 3004, serial no. 503 jate was unsupported and bent toward the pond. It does not appear operative.

In the pond side well of the drop inlet there are an d" C.I. and a 4" C.I. pipe near bottom of inlet. These were blocked but a 2" stream was flowing through the 2" pipe.

No water wis flowing over the top of the drop inlet and the brock's flow downstread of of the dam is the result of water flowing through the pipes.

RCS/js/rt

B.20

13. RELARMS AND RECCIBENDATIONS: (Continued)

The upstream face walls were catemaway along the water line so that reinforcing steel was exposed. The embandment is quite wide, 40' on top with many trees growing on the slopes. There are several 10" to 12" trees very near the drop inlet which should be cut. It. Herron Road, a 28' wide paved road with 6' shoulders occupies the top of the embandment. Surface drainage is controlled by berm and catch basins so there is little erosion of the slopes.

This dan does not appear to be a hazard to downstream area at this time but in order to keep it in good condition trees should be removed from the slopes and the gate at the upstream end of the penstock made operative.

See attached copy of plan view of sketch with items requiring attention noted in red.

Jamery 21, 1976

Mr. Mathem Tufts
359 Main Street
Box 511
Greenfield, Mass.

F2: Grepostion - Dan #2-6-217-2
Horthfield
Nelson Hills Jon
(Janyer Pends)

Dear Fr. Tufts:

On Movember 18, 1975, an engineer from the machantusette Department of Tablic Works made a visual inspection of the above due. Our records in Marke that you are the owner. Will you please notify this office if this information is not current.

The impaction was made in accordance with the provisions of Chapter 253 of the Massachusetts General Laws as amended (Dame-Safety Act). Chapter 700 of the Acts of 1975 transferred the jurisdiction of the se-safed "Date-Safety Program" to the Commissioner of the Department of Environmental Atallity Engineering.

The results of the impaction indicate that repairs are needed. It appears that little to no daintenance or repairs have been as less the netice of Gotoler 31, 1973 (dopy enclosed). The following conditions were noted:

- 1. The condition of the spalled concrete is about the same as the reinforcing steel is exposed at the water line.
- 2. The gate control housing is now entirely unsupported.
- 3. The growth of brush and treas has not been removed.
- h. No benver trash was noted at the spillway.

We again call these to your attention and expect your prompt action to correct these conditions. With any correspondence planse include the number of the day as indicated above.

Very truly yours,

IRAI jmp

601 Morthfield Conservation Commission F. J. Noev

Octuberioner

8-22

(i.)	LOCATION:				
/	6005/Town Northfie	ld . County F	ranklin	Dam No	2-6-217-2 .
	Name of Dam_Nelson	Mills Dam, "Sawyer F Mass. Rect.	Ponds"		.•
	Topo Sheet No. 13A	. Coordinates: N 617,	,600 , E 30	34,800	.• .
	Inspected by: Harolo	T. Shumway, On No	Dat v.18,1975 Las		on 9-4-73
(2.)	CLINER/S: As of Nov	ember 18, 1975			
	per: Assessors	, Reg. of Deeds,	Frev. Insp. \times ,	Per. Contac	et_X
	1 North on Tufto 250	Main Chroat Day Edd	Coordinal Man		
	Name	Main Street, Box 511 St. ω No.	City/Town	State	Tel. No.
	2				
	Name	St. α No.	City/Town	State	Tel. No.
. = :-	Name	St. α No.	City/Tovm	State	Tel. No.
31		e.g. superintendent, popular, popular, appointed by mul		inted by	
	same				
	Name	St. & No.	City/Town	State	Tel. No.
(4)	DATA:				
	No. of Picture Plans, Where Pl made in 1937. See V	s Taken none . Sketchans and specs. on file (ol. 15, Page 175 and	at County Commi plans for 1937 cor	issioners.c struction l	by Mass. DPW
(E)	of culvert, Northfield	,Mt.Hermon Sta.Roa	d @ outlet Nelson	Pond - Bri	idge #N-22-22
(2.)	DEGREE OF HAZARD: (i	f dam should fail compl	letely)*		
	1. Minor	•	3. Severe	•	
	2. Moderate	×	4. Disastrous		•
	• -	vays and culverts - Rt	e. 10 - B & M RR	line could	be affected.by
,, =	flood dama *This rating may char	ige. Nge as land use change:	(future developme	ent).	

OUTLETS: OUTLET CONTROLS AND DRAWDOWN
No. 1 Location and Type: northerly end of dam - conc. D.1 4' +W.x 5 1/2'H .
Controls none, TYPE:
Automatic . Manual . Operative Yes, No
Comments: D.I. box serves as overflow outlet - empties into concrete box. culvert - 8' sq.
No. 2 Location and Type: 32" dia. C.I. pipe under D.I. and inside of box culvert.
Controls yes , Type: Rodney Hunt gate valve Type 3004 - Serial 305 .
Automatic . Manual \times . Operative Yes . No \times .
Comments: Gate valve rod bent - control housing broken and timber supports
gone - gate silted over. No. 3 Location and Type: Outlet end of 32" C.I. pipe - 2 ea. 4" dia. C.I. pipes .
Controls yes, Type: Gate valves
Automatic Manual \times Operative Yes \times , No
Comments: Outlet end of 32" pipe has a steel plate with 2 ea. 4" dia. outlet
Drawdown present Yes X , No . Operative Yes , No X . Comments: controls broken - see item #2 above.
1 1/2:1 on earth embankment
DAM UPSTREAM FACE: Slopevert. on conc., Depth Water at Dam 6' ±
Material: Turf X . Brush a Trees X . Rock fill . Masonry X . Mood .
Other
Condition: 1. Good 3. Major Repairs X
2. Minor Repairs 4. Urgent Repairs
Comments: Concrete walls badly spalled and cracked, small cavities are appearing
from spalling of conc. near water line. Embankment slope has heavy brush and tree growth.
1.1 variable on embankment
DAM DOWNSTREAM FACE: Slope vert. on conc. Conc.
Material: Turf X . Brush & Trees X . Rock Fill . Masonry X . Wood
Other•
Condition: 1. Good 3. Major Repairs
2. Minor Repairs × 4. Urgent Repairs . B-24
Comments: Concrete structure good - embankment slope has heavy brush and tree
growth.

9. EMERGENCY SP	ILLUAY: Available none. Nee	eded_No	
Height Abo	ove Normal WaterFt.	•	
Width	Ft. Height	Ft. Material	•
Condition:	1. Good	3. Major Repair	9•
	2. Minor Repairs	. 4. Urgent Repair	rs•
Comments: 1	10' +, of freeboard from top o	of D.I. rim to road surf	ace along top of
<u>e</u>	embankment.		
<u></u>			
WATER LEVEL	AT TIME OF INSPECTION: 1/6	o Ft. Above × . Be	Low
Top Dam_	F.L. Principal	Spillway	•
Other Rim	n of drop inlet box		··································
Normal Free	eboard 10 Ft.		
SUMMARY OF DE	EFICIENCIES NOTED:		
Growth (Tre	ees and Brush) on Imhankment	Heavy brush growth and	2" to 12" trees.
Animal Burn	rows and Washouts none fou	ınd	
Damage to S	Signa on map of Dam minor e	erosion of slopes.	·
Cracked or	Damaged : conc. walls o	on upstream side of dam	badly spalled .
Evidence of	f Seepage none found		·
Evidence of	f Piping none found		·
Leaks	none found		Contract Secretarian and Contraction
Erosion m	ninor erosion of slopes		
Trash and/o	or Debris Impeding Flow no	one found	
Clogged or	Blocked Spillway none fou	and -	
Other			

(12.)	
	OVERALL	CONDITTION

1	٠	Safe
2	•	Minor repairs needed
3	•	Conditionally safe - major repairs needed ×
4,	•	Unsafe
5	•	Reservoir impoundment no longer exists (explain)
		Recommend removal from inspection list

(13)
REMARKS AND RECOMMENDATIONS: (Fully Explain)

Very little apparent repair has been made since last inspection of September 4, 1973. Spalling of conc. walls appear to be approx. the same as at last inspection. The Rodney Hunt gate control housing is now entirely unsupported by anything other than gate stem, which is badly bent. Beaver activity is still evident but there was no beaver trash around spillway area. Both gate valves on outlet end of drawdown conduit are now operable and both were closed at time of inspection. Water was flowing over rim of D.I. too forcefully to closely inspect interior of D.I. but structure appears to be still basically sound.

While the condition of dam structure itself is poor, the culvert conduit under highway appears good and this would control amount of water flow downstream. There is 10' to 12' of freeboard to top of highway which further reduces hazard to downstream area. It appears that total collapse of dam proper would create little damage to downstream area and would result mostly in draining impoundment.

HTS/bk

APPENDIX C

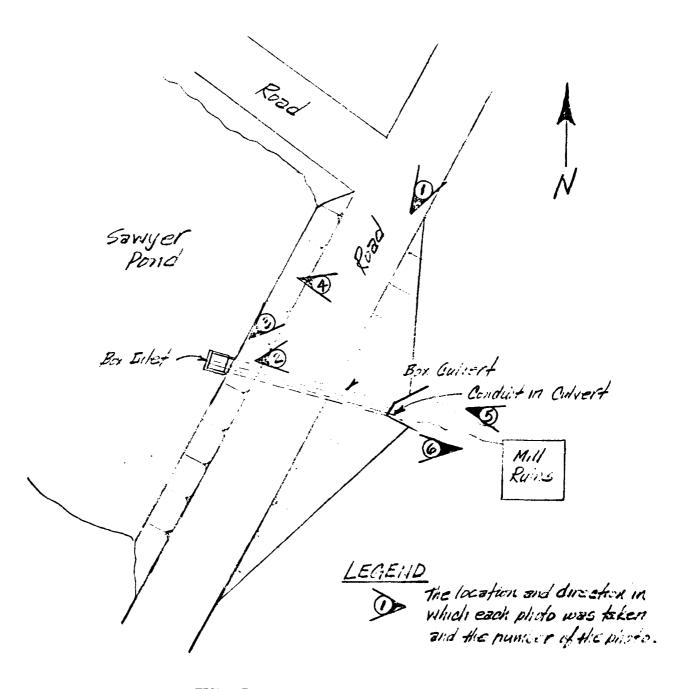
PHOTOGRAPHS

APPENDIX C SELECTED PHOTOGRAPHS OF THE PROJECT

		Page No.
Site	location plan	Α
PHOTO	OGRAPHS	
<u>No.</u>		
1.	View along the top of the dam from the left abutment. (12/4/80)	1
2.	Spillway box inlet viewed from the upstream slope of the dam. The inoperable gate hoist is in the back-ground. (12/4/80)	1
3.	Inoperable gate hoist and spillway box inlet as observed from the left side. (12/4/80)	2
4.	Sawyer Pond looking upstream from the dam. (12/4/80)	2
5.	Controlled outlet from the conduit in the spillway. (12/4/80)	3
6.	Ruins of mill about 50 feet downstream from the dam. (12/4/80)	3
7.	Bridge over stream about one mile downstream from the dam. (12/4/80)	4



Sawyer Porido Dani A



SITE PLAN



1. VIEW ALONG THE TOP OF THE DAM FROM THE LEFT ABUTMENT (12/4/80)



2. SPILLWAY BOX INLET VIEWED FROM THE UPSTREAM SLOPE OF THE DAM. THE INOPERABLE GATE HOIST IS IN THE BACKGROUND. (12/4/80)



3. INOPERABLE GATE HOIST AND SPILLWAY BOX INLET AS OBSERVED FROM THE LEFT SIDE.(12/4/80)



4. SAWYER POND LOOKING UPSTREAM FROM THE DAM.(12/4/80)



 CONTROLLED OUTLET FROM THE CONDUIT IN THE SPILLWAY. (12/4/80)



6. RUINS OF MILL ABOUT 50 FEET DOWNSTREAM FROM THE DAM. (12/4/80)



7. BRIDGE OVER STREAM ABOUT ONE MILE DOWNSTREAM FROM THE DAM (12/4/80)

APPENDIX D
HYDROLOGIC AND HYDRAULIC COMPUTATIONS

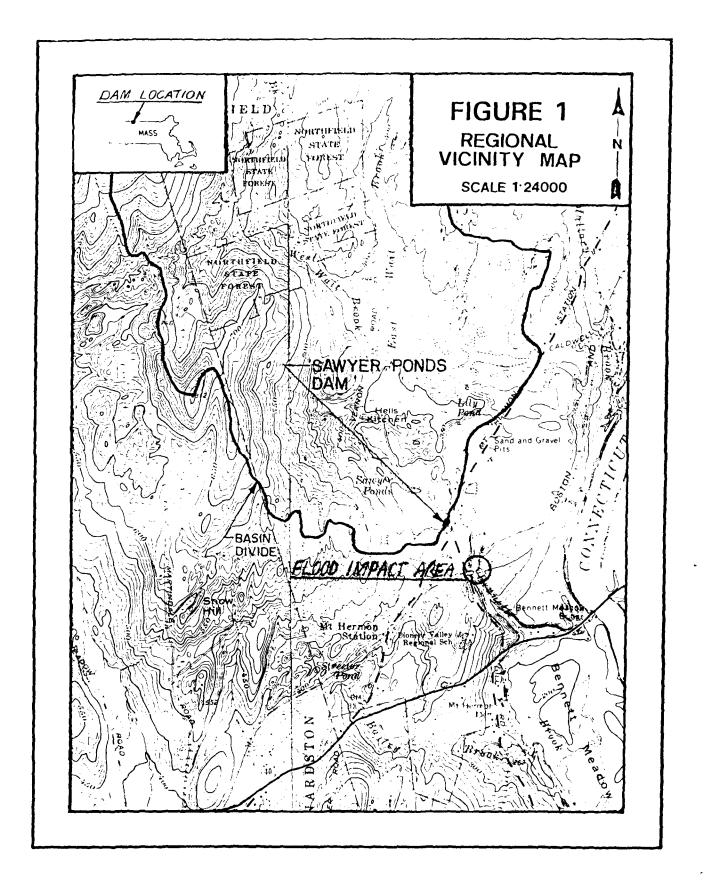
SAWYER POND DAM

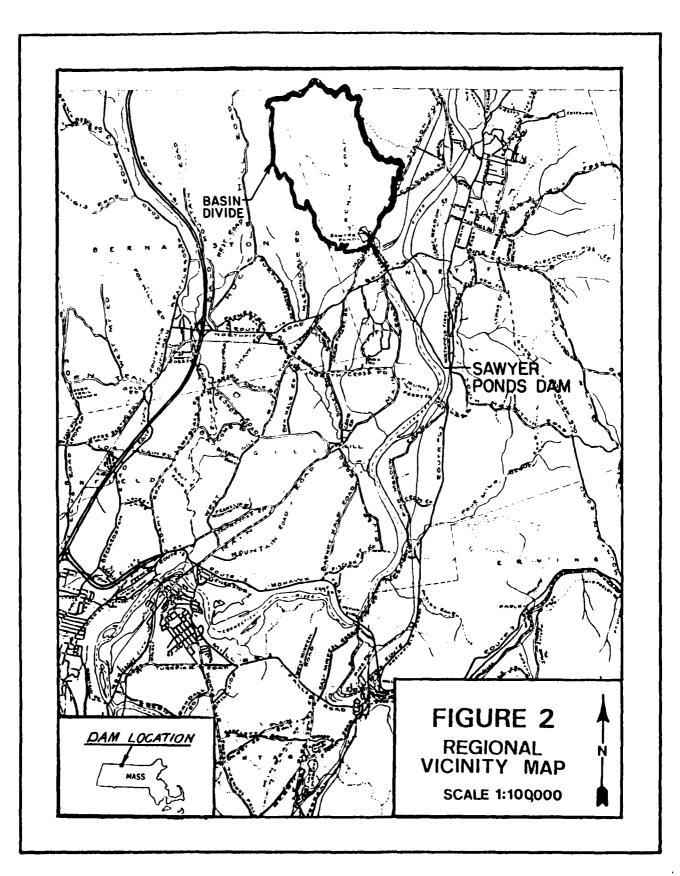
APPENDIX D

HYDROLOGIC & HYDRAULIC COMPUTATIONS

TABLE OF CONTENTS

			PAGE
Figure 1, Regional Vicinity Map Showing Flood Impact Area			D-1
Figure 2, Regional Vicinity Map Showing Entire Watershed			D-2
Drainage Area, Reservoir Area & Snyder Hydrograph Coeffic	ients		D-3
PMP Data, Spillway Plan & Section			0-4
Stage-Discharge Computations and Stage-Discharge Tabulati	on		D-5
Stage-Discharge & Stage-Storage Curves			D-6
Breach Configuration, Hazard Sections 1 & 2			D-7
HEC-1 Dam Safety Version, Non-Breach Computer Output	D-8	through	D-11
HEC-1 Dam Safety Version, Breach Computer Output	D-12	through	D-17





SAWYER POND DAM - HEH D-3 SHS 12/10/80 2060-002

HYDROLOGIC & HYDRAULIC

COMPUTATIONS

Drainage Area - 3.5 sq.mi.

Reservoir Area - From USGS Quad.

Elevation 318.5-

Spillway Crest (Elev. 332) - 18 Acres

Elevation 340 -

3/ Acres

O Acres

Elevation 350-

83 Acres

SNYDER Hydrograph Coefficients:

L= 3.0 miles

La = 1.4 miles.

$$= 2.0(3x/.4)^{0.3}$$

SURJECT	SHEET	Вт	DATE	JOB NO
SAWYER POND DAM - HEH	D-4	SHS	12/10/80	2060-002

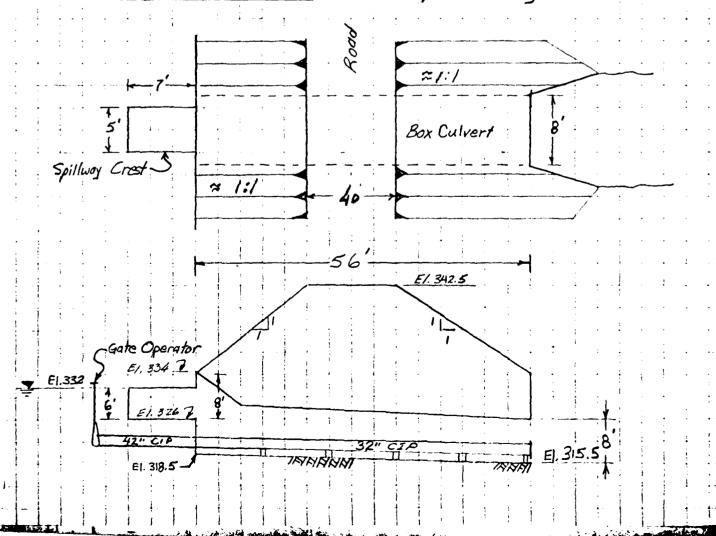
PMP DATA:

From HMS#33 - 24hr., 200 sq.mi Index Rainfall is 20 inches.

Distribution -

6 hr. 90 - 11.1 12 hr. 90 - 123 24 hr. 90 - 133

SPILLWAY PLANE SECTION: Box-drop inlet configuration.



OBRIEN & GERE

SUBJECT	SHEET	Вт	DATE	UN BILL
SAWYER POND DAM - HEH	D-5	SHS	12/11/80	2060.002

STAGE - DISCHARGE COMPUTATIONS:

1. Weir Discharge -
$$Q_w = CLH^{1.5}$$
 $C = 3.0$ $L = 1984$.

3. Dam Discharge -
$$Q_D = CLH^{3/2}$$
 $C = 2.8$, $L = 150.64$.
$$Q_D = 420H^{1.5}$$

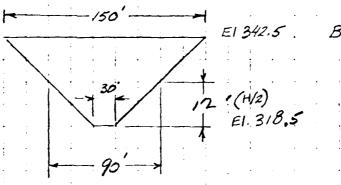
STAGE - DISCHARGE TABULATION

ELEV. H Q H Q H Q H Q EQ 331 0 0 - - - 0 333 1 57 - - - 57 337 5 637 7 662 - - 637 338 6 838 8 708 - - 708 340 - - 10 792 - 792 342.5 - 10 792 - 792 343 - - 13 903 0.5 148 1051 345 - - 15 970 2.5 1660 2630 350 - - - - - - - -	(MSL)	W	EIR	CULV	ERT	DA		(cfs).
332 0 0 0 333 / 57 57 337 5 637 7 662 - 637 338 6 838 8 708 - 708 340 - 10 792 - 792 342.5 - 125 885 0 0 885 343 - 13 903 0.5 148 1051 345 - 15 970 2.5 1660 2630	ELEV.	Hw	Q _N	He	Qu	Ho	$Q_{\mathcal{O}}$	€Q
1 330 1 1 65 1/60 /3 1/6/ 1/4/	332 333 337 338 340 342.5 343	0 < 5, 9,	o 57 637	1 7 80 0 15 m	- 662 708 792 885 903	- 0.5	0/48	0 57 637 708 792 885 1051

OBRIEN & GERE

SHEET	81	1	GA*E	J. IE NO
SAWYER POND DAM- HELD D-7	1 s	SHS	12/10/80	

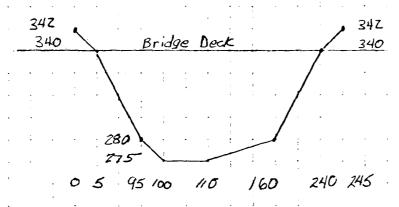
BREACH CONFIGURATION



Breach Width = 0.40 (90)

= 36 ft.

SECTION I HAZARD - Railroad Bridge

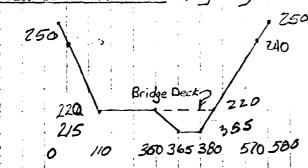


Manning's Coefficients:

Channel - 0.038 Overbanks - 0.08

Channel Slope - 0.028

SECTION 2 HATARD - Highway



Manning's Coefficients:

Channel - 0.038 Overbonks - 0.06

Channel Slope - 0.025

***********************		******	•••							
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PREVIEW OF SFOUENCE OF STREAM NETWORK CALCULATIONS

SAWYER DAM 0 RUNDEF HYDROGRAPH AT ROUTE HYDROGRAPH TO END OF NETWORK

SUM 21.28 20.08 1.20 165198. (541.)(510.)(30.)(5744.22)

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HYDROLOGIC ANALYSIS OF SAWYER POND DAM NATIONAL DAM SAFETY PROGRAM NFW ENGLAND DIVISION ~ CORPS OF ENGINEER	JOR SPECIFICATION IMIN IDAY THR IMIN METRC 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	PULTI-PLAN ANALYSES TO PE PERFCRME NPLANZ 1 NRTIC= 6 LRTIO= 1 .20 .25 .30 .40 .50 1.00	•	SUR-AREA RUNOFF COMPUTATION	SAWYER POND	ISTAG ICOMP IECON ITAPE JPLT SAWYER 0 0	HYPROGRAPH DATA TAPEA SN:F TRSDA TRSPC 3.50 0.00 3.50 0.00	PRECIP DATA 20.00 111.00 123.00 133.00 0	LOSS DATA SLICE ERAIM SIPKS RIICK (0.00 1.00 0.00 1.00	UNIT HYDROGRAPH DATA TP= 2.00 CP= .60 NTA:	STRIGE -1.70 ORCENT10	47 END-OF-PERIOD ORDINATES, LAG= 21*, 335, 462, 175, 429, 574, 534, 594, 121, 107, 94, 83,	74. 50. 27. 23. 10. 9. P. 7.	FND-OF-FERTOD FL
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Entry To Security Control Control

Property and a second

PEAM FLOW AND STORAGE (END OF PER106) SUMMARY FOR MULTIPLE FLAN-RATIO ECONOMIC COMPUTATIONS FLOW AND STORAGE FOR SECOND (CURIC METERS PER SECOND).
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SUMMARY OF DAM SAFETY ANALYSIS

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10P 0F 5AM 342.50 345. PRS.	TIME OF MAX DUTFLOW HOURS	20 134.50 119.50 118.75 118.25
	DURATICN OVER TOP HOUPS	0.84 5.00 5.00 5.00 5.00 5.00 5.00 5.00
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